

MEMORANDUM

Subject: Evaluation of the Perimeter Air Monitoring Strategy and Identification of Corrective Actions at the TVA Kingston Fly Ash Release Time-Critical Removal Action

From: Leo Francendese
EPA On-Scene Coordinator

To: Steve McCracken
TVA Kingston Project Manager

Date: January 25, 2010

The following memorandum discusses the results of the recent perimeter air monitoring evaluation at the TVA Kingston Fly Ash Release site (the Site) and identifies corrective actions that are required as part of these findings.

During the week of January the 11, 2010, an audit was conducted by the USEPA Region 4 Science and Ecosystem Support Division (SESD) that included a review of soil, sediment, biota and air monitoring data, as well as a field observation of water sampling methods, being performed by TVA. Included in the review of the air monitoring data were metals, silica, filter-based low volume PM_{2.5} and PM₁₀ particulate matter, high volume particulate PM₁₀ particulate matter, meteorological, and continuous tapered element oscillating microbalance (TEOM) data. No significant issues were found with any of these monitoring parameters with the exception of the PM_{2.5} and PM₁₀ filter based particulate data generated during the period from mid-September 2009 to mid-January 2010. The draft audit findings have been documented in a separate bulleted summary. Please see Attachment 1. These deficiencies necessitated an evaluation of the protectiveness of the perimeter air monitoring strategy during the period in question, as well as identification of corrective actions to be implemented to ensure similar deficiencies are not repeated.

The findings of the quality assurance audit document that low-volume, filter media, airborne particulate sampling at the five stationary monitoring stations failed to meet quality assurance procedures as specified in the Dust Control and Air Monitoring Plan and accompanying Quality Assurance Project Plan required by the Administrative Order and Agreement on Consent (AOC) between our respective agencies. Both plans may be found at www.epakingstontva.com. Essentially, low-volume analyses during this period were not consistent with required EPA protocol, and will therefore not be utilized. Other data collected as part of the overall air monitoring strategy, however, indicate that public health was protected during the time period in question.

Effectiveness of Perimeter Air Monitoring Strategy

Redundant air monitoring systems exist on the Site and there is quality assured data available for the September to January time period. These systems, when viewed in total and considering the environmental conditions, indicate that the public has not been exposed to unacceptable risk from fugitive dust migrating from the Site.

The overall perimeter air monitoring strategy comprises multiple elements categorized as follows:

- Surrounding the adjacent perimeter of the Site are five fixed monitoring stations.
- Mobile monitoring is performed on a daily basis.
- Industrial hygiene sampling within the exclusion zone to monitor working conditions.
- Work management practices that include visual on-site dust monitoring with accompanying engineering controls.

The five fixed air monitoring stations are described and itemized in Attachment 2. Filter-based particulate media sampling, which may include PM_{2.5}, PM₁₀ or both, is performed at all these locations, and is described as the set of data that failed to meet EPA quality assurance requirements. Station PS07 is viewed as the most critical station as it is located downwind of the prevailing wind direction from the Site and is thus positioned to monitor worst case air quality conditions. In addition to filter-based sampling, Station PS07 is also equipped with Tapered Element Oscillating Microbalance (TEOM) real-time particulate monitors. TEOMs are considered federal reference equivalent methods. PM_{2.5} and PM₁₀ TEOM monitors are maintained at Station PS07 by TVA and the Tennessee Department of Environment and Conservation (TDEC), respectively. Data from the TEOM monitors have been determined to meet quality assurance standards.

In addition to TEOM monitors, and because it is immediately adjacent and downwind of the Site, Station PS07 is equipped with additional monitoring capabilities not present at the other four locations, including equipment to sample for airborne silica and metals. Silica and metals data generated from this station have been determined to meet quality assurance standards.

To augment monitoring provided by the five fixed stations, mobile air quality monitoring of the Site perimeter is conducted using PM₁₀ handheld instrumentation on a near daily basis. Frequency of such monitoring ranges from 200 to 400 individual samples per day. The typical spatial distribution of real-time PM₁₀ monitoring is given in Attachment 3.

Industrial hygiene sampling is conducted on a frequent basis to determine whether workers are being adequately protected and augments data generated through perimeter air sampling and monitoring. As industrial hygiene sampling is performed within the actual work zone, the generated data are viewed as representing worst case air quality conditions. Please see Attachment 4 for the spatial distribution of these samples during this time period.

Site management includes a full-time staff whose responsibility includes frequent visual observations to view, document, and control fugitive air emissions. Flexterra® temporary ground cover covers 30% to 75% of the on-site extent of coal ash at any given time. Such response actions have significantly reduced the extent of the coal ash that potentially contributes to fugitive air emissions. Coal ash that remains uncovered is managed by maintaining appropriate moisture to prevent migration or is graded to allow a hard crust to form over its surface, which effectively seals the coal ash in place.

Evaluation of the effectiveness of the redundant air monitoring systems must consider environmental conditions that existed during the timeframe in question. The risk of fugitive dust migration is reduced to near zero during rain events and for a period of time thereafter. Precipitation occurred on-site 58 out of 142 days from mid-September until mid-January, or approximately 40% of the total number of days. The frequency and volume of rainfall during this period is such that high ambient soil moisture conditions were maintained during much of the time.

Results of Measurements in Redundant Systems Indicate Public Health Protected

Prior to mid-September 2009, filter-based samples collected by TVA at all five perimeter monitoring stations were analyzed using the correct analytical procedure. Data collected from these five stations during the period prior to mid-September correlated well with one another and exhibited no substantial variation from station to station. The filter-based data also correlated well with concurrent TEOM PM_{2.5} and PM₁₀ data.

From the mid-September through mid-January time period during which filter-based PM data were found not to meet quality assurance standards, PS07 TEOM PM_{2.5} and PM₁₀ measurements indicate that airborne particulate matter concentrations for both parameters were below National Ambient Air Quality Standards (NAAQS) reference values. The Dust Control and Air Monitoring Plan uses a project management action level of 75% of NAAQS, or 112 microgram per cubic meter (ug/m3) for PM₁₀ and 26 ug/m3 for PM_{2.5}. Given the **strong correlation between TEOM and filter-based data established prior to mid-September, the Agency is confident that mid-September thru mid-January PS07 TEOM measurements are representative of conditions at other 4 locations around the perimeter of the Site.**

The above observation alone gives the Agency confidence that the public was protected during the mid-September to mid-January timeframe as these measurements were consistently below NAAQS reference values. Please see Attachment 5 for a graphic representation of these relationships as well as the TEOMs' reliability in tracking station to station relationships.

Additional weights of evidence supporting this determination are as follows:

- Thousands of mobile PM₁₀ instantaneous readings during the time period of mid-September to mid-January also are significantly below NAAQS reference values.
- Approximately 150 industrial hygiene sampling events were conducted within the exclusion (work) zone during the time period in question. The data derived from these sampling events demonstrate that on-site dust control and air quality objectives were being met in that these measurements were significantly below on-site health and safety triggers. These data also support the reasonable conclusion that Site conditions during this period would not promote fugitive emissions that would adversely impact perimeter ambient air quality conditions.
- Filter-based media sampling data for silica and metals met quality assurance requirements during the subject time period and indicate that airborne concentrations for these parameters were below reference values.
- Precipitation events occurred 40% of the time during this period. Assuming that moisture content was retained for a period of time after each, it is reasonable to conclude that Site conditions were such that fugitive dust emission risks were low for Site conditions for greater than 40% of the period in question.
- Rigorous on-site management practices for dust suppression have significantly reduced the coal ash that is subject to wind entrainment and dispersion.

Corrective Actions Underway

While, based on quality assured data available from Station PS07 and from other data generated through the multiple and redundant monitoring strategy, the Agency is confident that the public was protected during the mid-September to mid-January period, it is imperative that corrective action be taken to ensure that all data collected at the Site meets applicable federal guidelines. The following corrective actions will be conducted:

- TVA will submit an investigative report regarding this incident.
- EPA audit staff will participate in TVA's QA weekly conference calls with its analytical laboratories.
- EPA audit staff will conduct audits of TVA contract laboratories on a periodic basis.
- EPA will conduct periodic independent sampling and performance audits of TVA's air monitoring network.
- TVA will submit a Corrective Action Plan and schedule for accelerating the validation of raw data in order that it can be released for review on a more timely basis.
- TVA will submit a Corrective Action Plan for upgrading its perimeter stations to include additional TEOM monitors.

EPA acknowledges that TVA has already taken immediate action to terminate use of the laboratory that generated the non-assured data and looks forward to implementation of the corrective actions specified above. EPA will also consider any additional steps that TVA might offer to improve the Site air monitoring strategy.

Attachment 1

**Audit Summary for the TVA Kingston, Tennessee Fossil Plant
EPA Science and Ecosystem Support Division
January 11-14, 2010**

Auditors:

Ray Terhune, Quality Assurance Section
Greg Noah, Air and Superfund Section
Tim Slagle, Air and Superfund Section
Linda George, Air and Superfund Section
Jeff Hendel, Quality Assurance Section

Introduction

On January 11-14, 2010, the EPA Science and Ecosystem Support Division (SESD) conducted an audit of the TVA Fossil Plant located in Kingston, Tennessee at the request of Leo Francendese, On-Scene Coordinator for the TVA Kingston Fly Ash Spill response. The audit included a review of water, sediment, ash, tissue and air monitoring data as well as field observations of water sampling methods. Included in the review of the air monitoring data were metals, silica, filter based low volume PM_{2.5} and PM₁₀ particulate matter, high volume PM₁₀ particulate matter, meteorological, and continuous TEOM data. Data collected from April 2009 to December 2009 were included in this audit.

Summary of Audit Observations and Recommendations

No significant issues were found during the audit of sampling activities for the surface water, sediment, ash or air. There were also no significant issues found with the laboratory data for the surface water, sediment, tissue or ash samples. Nor were there any problems found with the laboratory data for the metals in air. However, there was a notable exception with a portion of the laboratory analysis of the PM_{2.5} and PM₁₀ filter based air particulate data. The low-volume PM_{2.5} and PM₁₀ filter based sampling at the 5 fixed particulate monitoring stations that occurred from September 16, 2009 to January 13, 2010 analyzed by the Bureau Veritas contract laboratory failed to meet required quality assurance requirements and analysis methodology required by the Air Monitoring Plan and accompanying quality assurance project plan. All low-volume PM_{2.5} and PM₁₀ filter analysis conducted before September 16, 2009 by the Inter-Mountain Laboratory showed acceptable quality assurance and conformance to analysis methodology. EPA strongly recommends that the data analyzed by the Bureau Veritas contract laboratory for the September 16 to January 13 timeframe be "R" flagged.

The auditors also noted that the amount of time that elapses between the air sampling events and the data being released from TVA's Quality Assurance may lead to future potential excessive data loss if other similar laboratory errors occur. The auditors

recommend TVA reduce the time it takes to complete the quality assurance reviews from 3-months to 30-days if possible.

Audit Observations

Water, Sediment, Ash, and Tissue

Sixteen random data packages were reviewed of various matrixes (water, sediment, ash, and tissue (several species). Data packages from several laboratories were reviewed including: TestAmerica - Nashville, TN; TestAmerica - Knoxville, TN; TestAmerica, Pittsburgh, PA; and Pace Analytical - Green Bay, WI. The primary analyses of interest were metals and nutrients (ammonia, TKN, etc) and physical properties (TSS, TDS, turbidity, pH, etc).

- The data was acceptable for nutrients in the reviewed packages in all matrices tested (water).
- The data was acceptable for physical analyses in the reviewed packages in all matrices tested (water).
- The Quality Assurance requirements for laboratory analyses were more stringent in the data analysis plan than the analytical method requirements for each analyte.
- There were numerous checks and balances between the laboratories and the data review team with excellent communication between all parties.
- Metal analysis method/procedure blanks for tissue samples had numerous low level hits of analytes of concern. This indicates a minor contamination issue with the procedures. Although this is quite common in tissue preparation it does cast some doubt on low level concentration values of metals in samples.
- The electronic data and deliverables are stored on two redundant servers and are backed up four times daily.

Field Sampling Methods

- The sampling procedures were followed as written with no deviations noted.
- The SOPs have been updated and reviewed as needed when project operations change.
- The field logs reviewed were detailed and complete.
- One sample in ten is collected for quality assurance (matrix spikes and/or duplicates) which surpasses the EPA requirement of one sample in twenty.
- The calibration room was set up very well and the procedure for performing the day's calibration was very efficient.
- Hydrolab probes were adequately rinsed between standards. The Hydrolab data was stored in the memory of the instrument at each of the sampling locations.
- In addition to storing the information in the memory of the instrument, the field measurements were also recorded in the field notebook. This redundancy is a good practice in the event of a memory failure within the hydrolab software.

- Safety glasses were not utilized during calibrations which involve the handling of standards, reagents, and/or sample bottle preparation in the calibration and sample preparation rooms.
- Eyewash stations were not present at the instrument calibration and sample preparation rooms.
- Three equipment volumes should be purged prior to sample collection.
- The filter cartridge should be purged prior to sample collection.

Air Monitoring Data

Several random data packages of several monitoring parameters were reviewed including low volume particulate data (PM_{2.5} and PM₁₀), Tapered Element Oscillating Microbalance (TEOM) continuous particulate data (PM_{2.5} and PM₁₀), meteorological, metals, and silica data. Data packages from several laboratories were reviewed including: Inter-Mountain Laboratory (IML) – Sheridan, WY; Bureau Veritas, Novi, MI; and Galson Laboratories – Syracuse, NY. Observations for each monitoring parameter are below:

Low Volume Particulate Data

Two contract laboratories have been used to weigh PM₁₀ and PM_{2.5} low volume samples during the time of this project. IML was contracted for filter weighing from the start of the ambient perimeter monitoring network through mid-September, and Bureau Veritas was used from mid-September through the time of the audit. The reviews for each laboratory are below.

Inter-Mountain Laboratory (IML)

- Several samples were traced from the pre-weighing session, through field handling, and post weighing to determine if essential documentation was present and acceptable for validation. All records and quality assurance records were present for validating these samples.
- The records were not adequately organized by the record keeper and the review took more time than expected for this exercise. The data packages and field data should be catalogued and organized in a logical manner to speed review.

Bureau Veritas

- Several samples were traced from the preweighing session, through field handling, and post weighing to determine if essential documentation was present and acceptable for validation.
 - No laboratory blank data or duplicate data was reported, and the working standard weights did not effectively bracket the expected weight of the filter media.
 - The data packages were not clearly organized.
 - TVA reported that several filter weighings showed significantly high negative numbers that are impossible to achieve in routine monitoring.
 - TVA observed and showed EPA a wider range of scatter than previously observed among measurements at the TVA ambient air monitoring sites.
- The above observations prompted a laboratory audit of the Bureau Veritas laboratory by TVA. The following findings are the critical elements of deficiency recorded by TVA during the Bureau Veritas Laboratory audit.

1. Inadequate static control in the laboratory was observed.
 2. Temperature and humidity requirements as specified by 40 CFR Part 50, App.L Sec 8.2 were not followed.
 3. Pre- and post-weighing humidity criteria as specified by 40 CFR Part 50, App.L Sec 8.3.3 were not met.
 4. No lab blanks or replicate weighings were conducted as specified in 40 CFR Part 50, App.L Sec 8.3 and 7.11.
 5. The balance check standards were inappropriate to properly bracket the filter media weight and confirm the repeatability of the balance.
 6. The balance was configured to only weigh to 5 places (0.00000g) instead of the required 6 places (0.000000g).
 7. From interviewing the TVA auditors, their opinion was that the laboratory was using a “NIOSH 0600-type” weighing procedure instead of the EPA Method Specified in the Dust Control and Air Monitoring Plan. The TVA auditors concluded that the laboratory Bureau Veritas was not familiar with EPA filter weighing methodology. However, further review of the data by the EPA auditors concluded that the laboratory made significant deviations from the NIOSH 0600 Method.
- EPA strongly recommends that the low volume PM_{2.5} and PM₁₀ data analyzed by the Bureau Veritas contract laboratory for the September 16 to January 13 timeframe be “R” flagged.

Continuous PM_{2.5} Tapered Element Oscillating Microbalance (TEOM) Data

- The PM_{2.5} TEOM data is automatically transmitted electronically to the TVA Environmental Compliance & Modeling Support Group located in Muscle Shoals, AL.
- The data is reported in real-time and is posted on the TVA Kingston website.
- The TEOM is audited approximately every two months, and the quality assurance checks (flow, temperature, barometric pressure) are acceptable. However, EPA recommends monthly flow checks for the TEOM.
- Data collected on September 10 through 14 show several consecutive zero measurements indicating a possible instrument problem. The review process should be augmented to include daily reviews and investigation and communication of any anomalous measurements.
- The data was found to be acceptable.

Meteorological Data

- The meteorological data is automatically transmitted electronically to the TVA Environmental Compliance & Modeling Support Group located in Muscle Shoals, AL.

- The Environmental Compliance & Modeling Support Group has audited the meteorological equipment quarterly, and the monitor has passed each audit.
- No issues were found with data integrity or quality assurance.

Metals Data

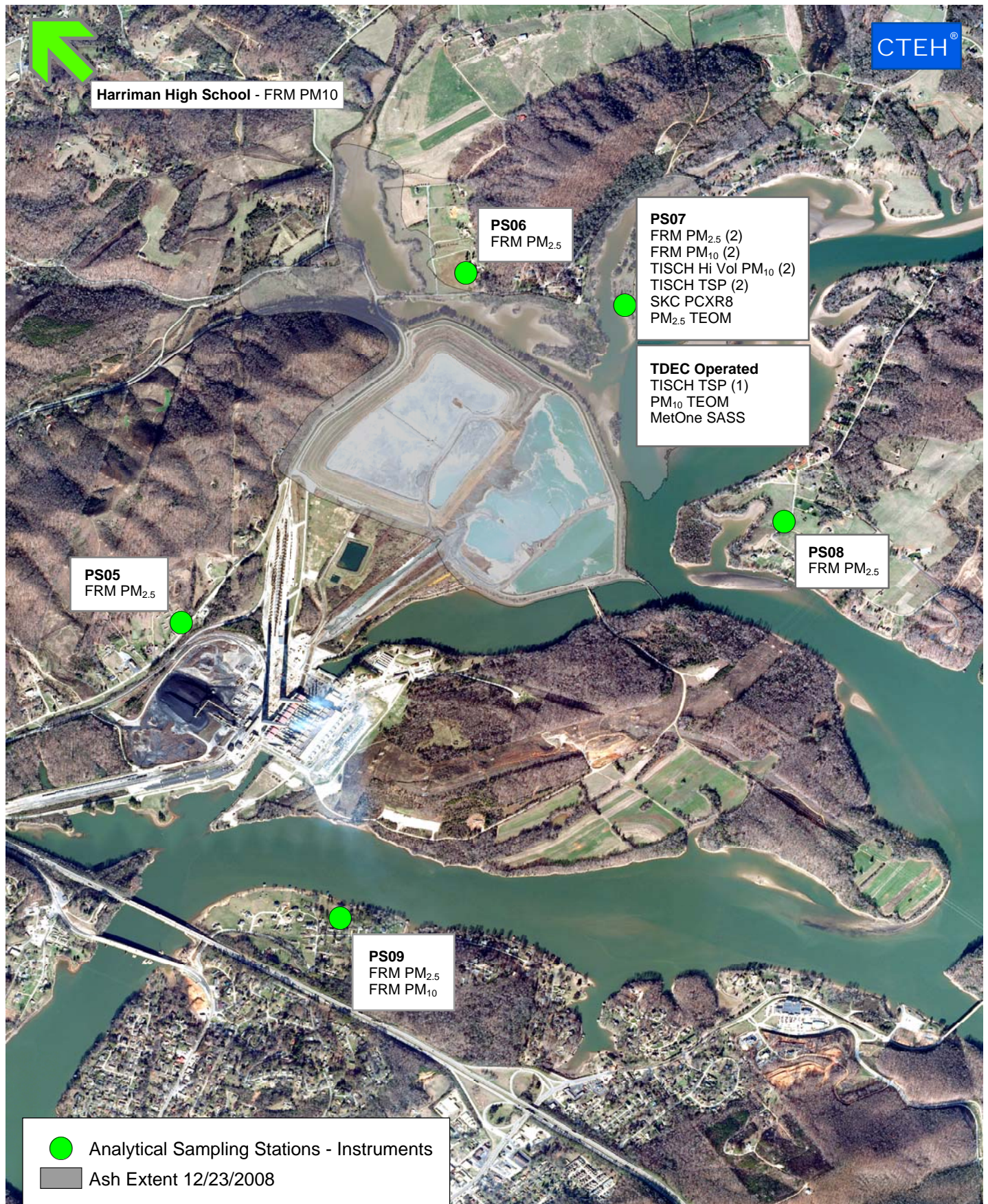
- Several data packages were reviewed from both IML and Bureau Veritas and found no issues with data integrity or quality assurance.

Silica Data

- Several data packages were reviewed from Galson Laboratories and no issues were found with data integrity or quality assurance.

Attachment 2

Particulate Monitoring Stations



**Stationary
Particulate Monitoring
Stations**

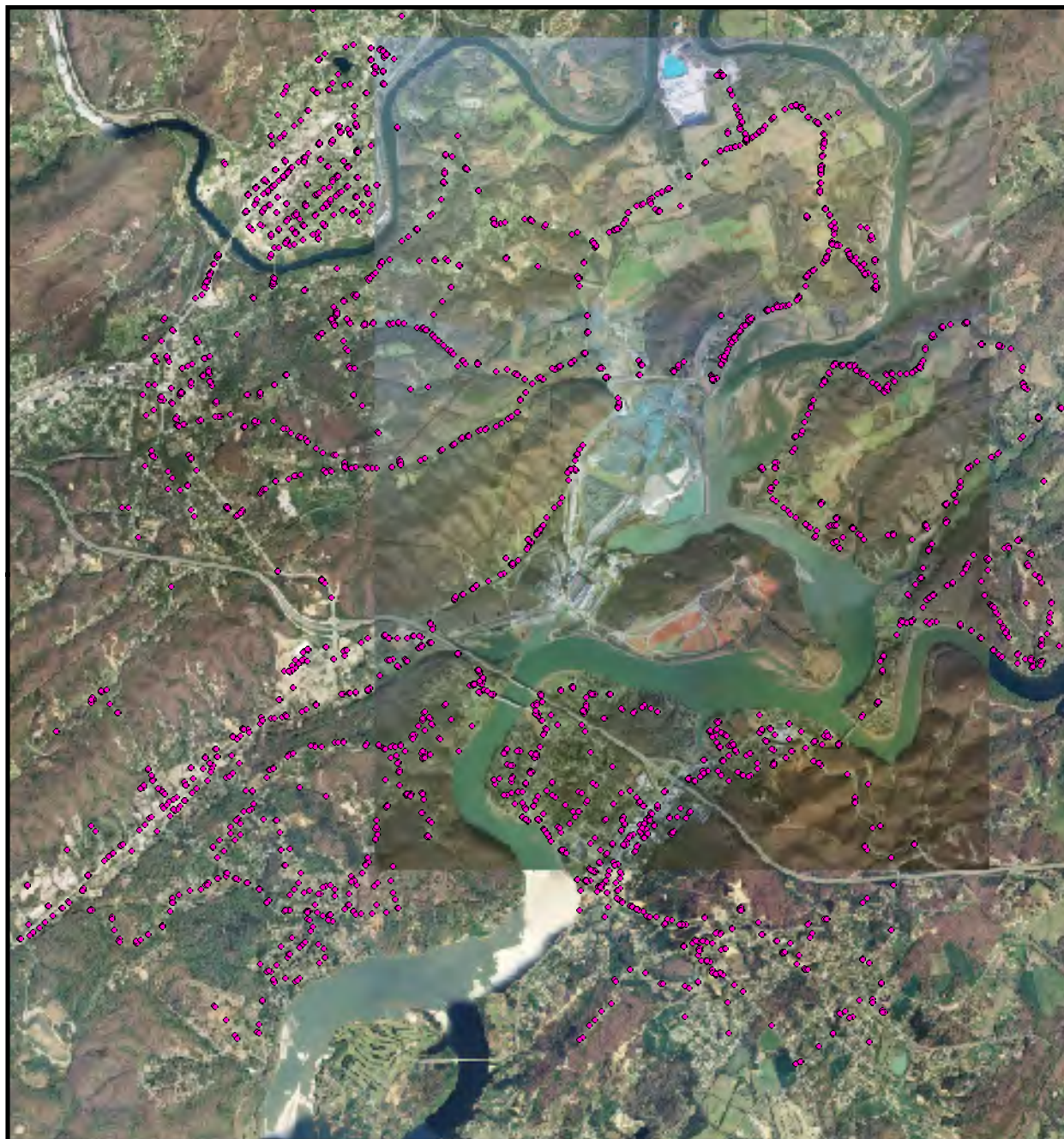
FIGURE 1



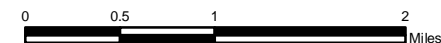
CTEH® Project No. 4735	Tennessee Valley Authority
	Kingston, TN
	Roane County
Date Printed: 07/28/2008	

Attachment 3

PM10 Mobile Monitoring



◆ Real Time PM10 Mobile Monitoring Samples
(10/01/09 - 10/08/09)



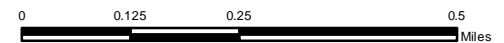
Date of Imagery:
Plant Area: 12/01/2009
Other Area: 2008

Tennessee Valley Authority
E&T - Environmental Resources
Geographic Information & Engineering

Attachment 4

Industrial Hygiene Monitoring

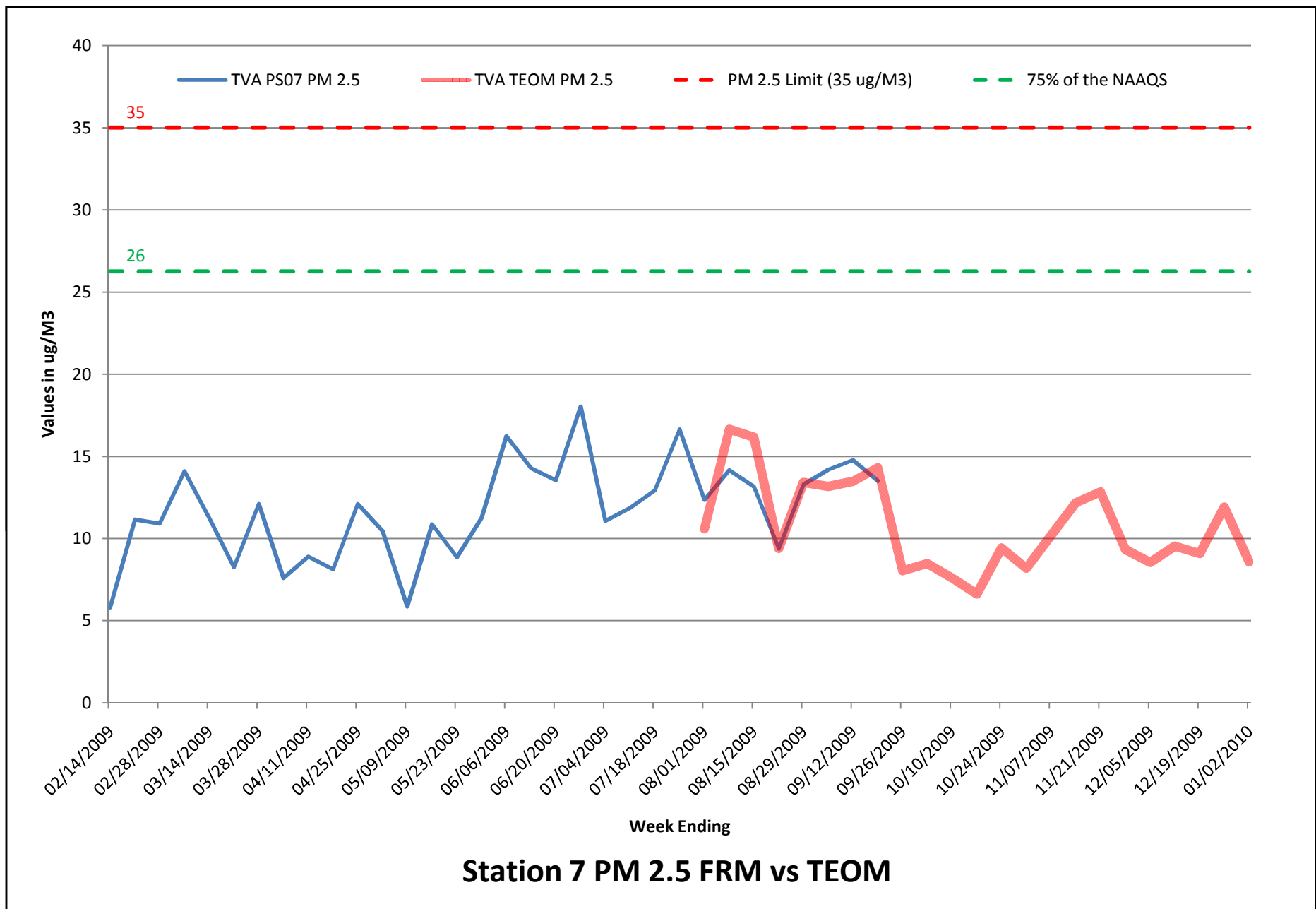
- Industrial Hygiene Monitors



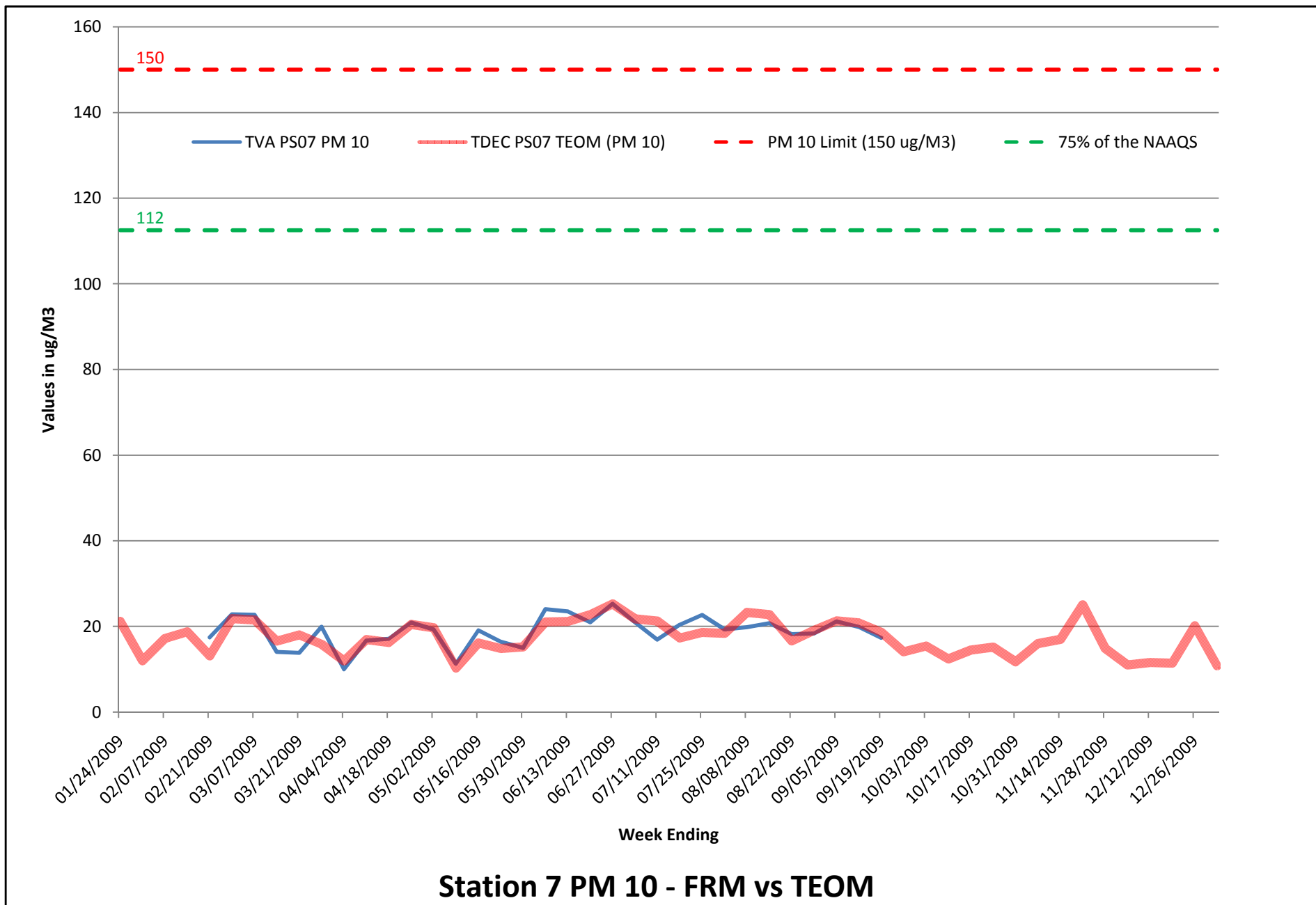
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Tennessee Valley Authority
E&T - Environmental Resources
Geographic Information & Engineering

Attachment 5

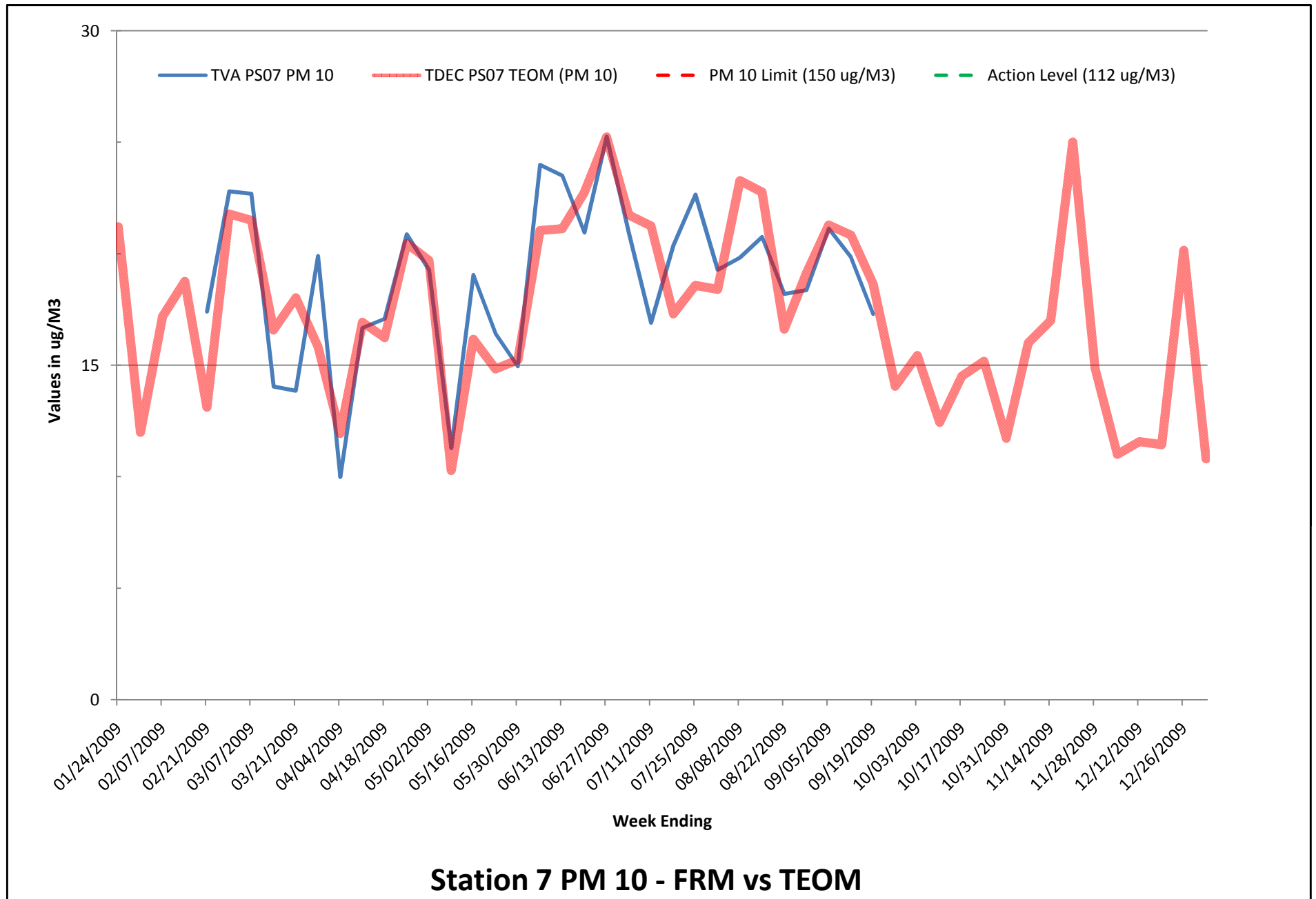


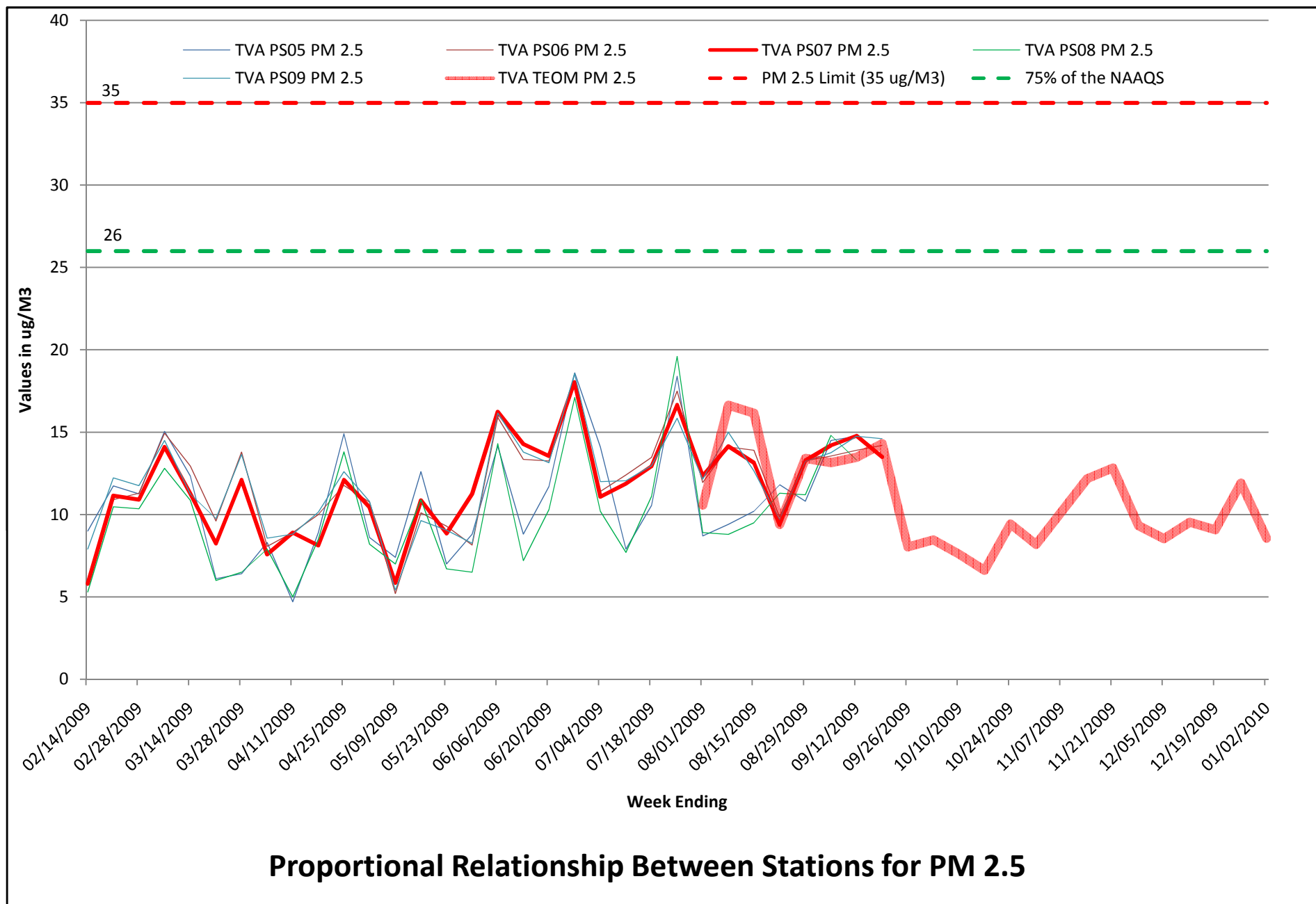
Graph 1



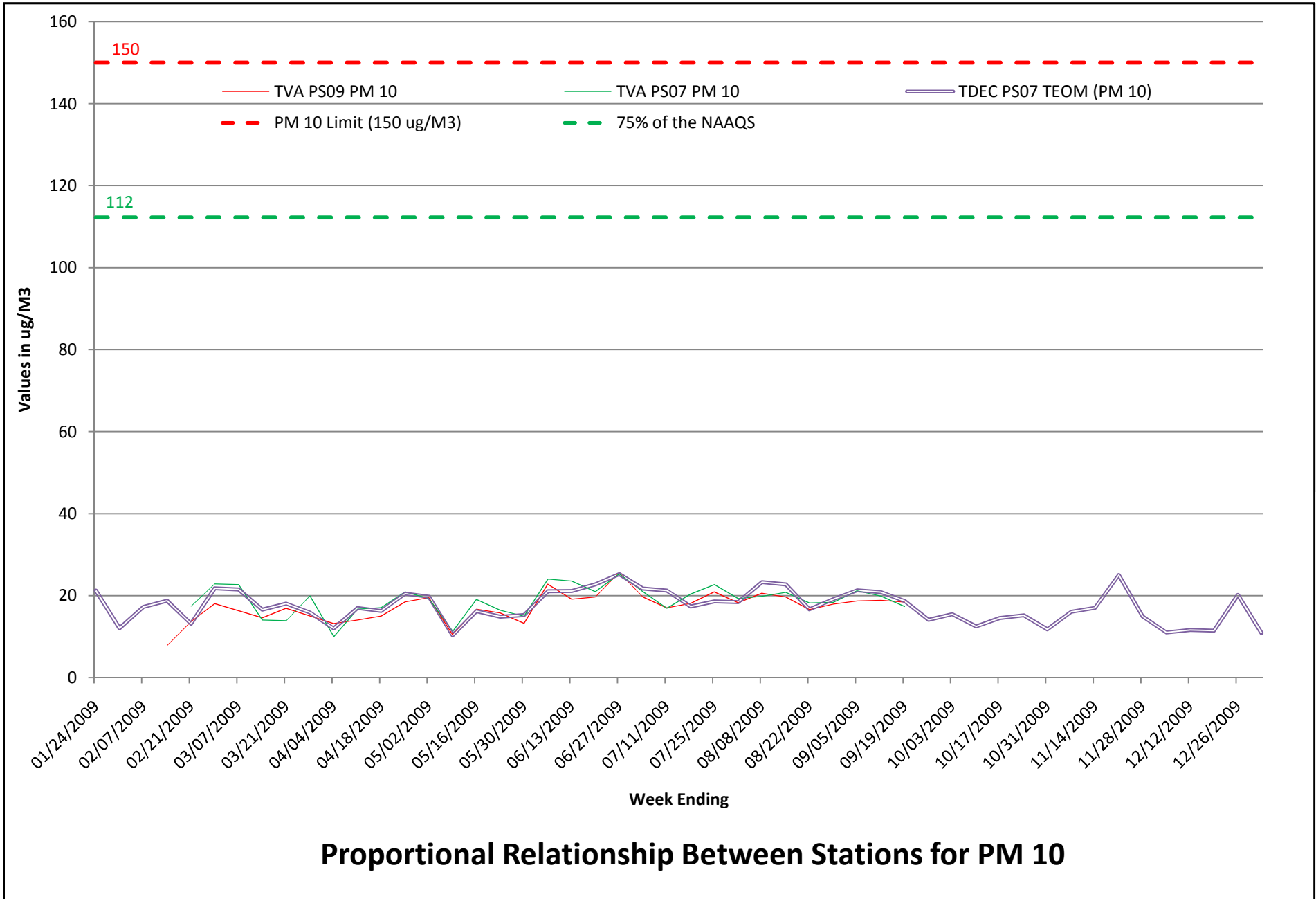
Graph 2

View Magnified 533%





Graph 3



Graph 4

View Magnified 533%

